

# Topology Trigger for Low Multiplicity Events in Ultra-Peripheral Collisions at STAR

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Ultra-peripheral collisions [1] involve coherent electromagnetic interactions at large impact parameters  $b > 2R_A$ . In  $AuAu \rightarrow AuAu\rho^0$  a photon is emitted by one nucleus and fluctuates to a  $q\bar{q}$  pair which scatters elastically from the other nucleus forming a vector meson at low  $p_T < 2\hbar/R_A \sim 100$  MeV. This process has a specific experimental signature: the  $\pi^+\pi^-$  decay products of the  $\rho^0$  meson are observed in an otherwise 'empty' spectrometer; the pion tracks are back-to-back in the transverse plane. The two nuclei remain in their ground state, therefore no signal is detected in the zero degree calorimeters.

A special trigger was implemented for this low-multiplicity event topology, suppressing background from cosmic rays, beam gas events, and debris from upstream interactions. For the level 0 trigger, the central trigger barrel was divided in 2 rings  $-1 < \eta < 0$  (East) and  $0 < \eta < 1$  (West) of quadrants: North, South, Top, and Bottom. A hit was required in both a South and a North quadrant in either East or West, while the Top and Bottom quadrants acted as a veto to suppress cosmic rays. In addition, a 4-track topology South and North in East and West was allowed. A fast online reconstruction — the level 3 trigger — eliminated events with more than 15 tracks and events with tracks not emerging from the collision region.

Using this trigger, the STAR collaboration collected 7 hours of data in 2000. The level 0 trigger rate varied from 20 to 40 Hz and was reduced to about 1-2 Hz by the level 3 trigger. About 200 exclusive  $\rho^0$  candidates at small transverse momenta  $p_T < 100$  MeV were found — the first

observation of the process  $AuAu \rightarrow AuAu\rho^0$  in heavy ion collisions.

## References

- [1] S. Klein and J. Nystrand, Phys. Rev. **C60**, 014903 (1999).
- [2] F. Meissner and the STAR Collaboration, "Ultra-peripheral collisions," poster presented at Quark Matter 2001.

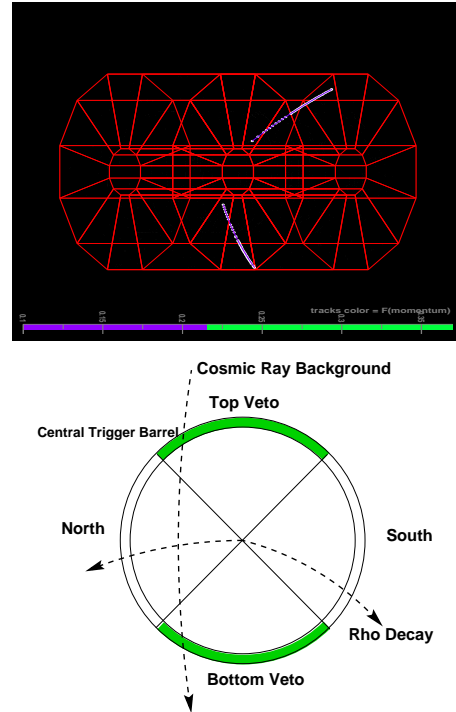


Figure 1: (a) Typical event for  $\rho^0$  production in Ultra-Peripheral Collisions: only the decay products of the  $\rho$  meson are observed. (b) Trigger setup in the transverse plane: a back-to-back topology is required for the  $\rho^0$  decay, cosmic rays are suppressed by a top-bottom veto.

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